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Association of picky eating habits with dietary intake and growth status in early childhood

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Abstract

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Picky eating is frequently observed in early childhood and relate to feeding difficulty, eating small amounts, food neophobia, and strong preference for food types or cooking methods. This eating problems can lead to improper nutritional and growth status in children which can continue to adolescence and adulthood. However it has not been well defined and generally measured by perception of caregivers. Also, the association between picky eating behaviors and nutritional status has not been investigated in depth.

So, this study was performed to evaluate the picky eating habits of toddlers and preschool children using a multi-faceted approach and to examine the association between picky eating behaviors and dietary intake and growth status.

A cross-sectional study was conducted on the caregivers of children aged between 1 and 5 years in the Seoul Metropolitan area between September 2014 and July 2015. The survey included a self-administered questionnaire about food behavior of children and sociodemographic information and care environment, anthropometrics, and non-

consecutive 3 days food records. This study included the data of 184 children from the self-reported data of 221 children's caregivers; 37 children were excluded because of incomplete dietary data and problems affecting food intake.

Perception of caregivers was assessed involving feeding difficulty and pickiness of child. Four constructs of children's picky eating behaviors included eating small amounts, neophobic behavior, refusal of specific food groups, and preference for a specific food preparation method. Differences in the nutrient intake and growth status between picky eaters and non-picky eaters were tested by ANCOVA test, after adjusting for sociodemographic characteristics.

The highest proportion of picky eaters was preference for a specific food preparation method. Picky eating behavior occurred more frequently than perception of caregivers. Perception of caregivers about feeding difficulty and pickiness was relate to lower intake of energy and some micronutrients and poor growth, especially in children aged 4 to 5 years. Children 'eating small amounts' consumed less energy and most micronutrients, except calcium, but other picky behaviors resulted in a significant difference regarding nutrient density for some micronutrients. 'Eating small amounts' was related to lower growth status; whereas the other picky behaviors did not show any significant difference in growth status. Specific picky behaviors were related to perception of caregivers; especially eating small amounts was strongly related to the perception of caregivers.

This study identified that picky eating problems occurred in Korea, similar with other countries and specific picky eating behaviors, especially 'eating small amounts', were related to the insufficient nutrient intake and lower growth status in early childhood and can lead to feeding problems to caregivers. Thus, intervention to improve the eating

behaviors of children and education regarding favorable feeding practices for caregivers are required to help children establish healthy eating habits.

Keywords: Picky eating, eating habits, toddlers, nutrient intake, growth status

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I. INTRODUCTION

1. Background

Picky eating is a frequent eating problem in childhood which many parents are concerned about (Jacobi, Schmitz and Agras 2008). Studies have reported that more than 35% of US toddlers aged between 12 and 24 months (Carruth et al. 2004), 17% of Chinese preschoolers (Li et al. 2001), and 24% of 4- to 5-year-old Korean children (Lee 2013) were classified as picky eaters.

Picky eating habits can cause an unfavorable diet and less than optimal growth of children (Carruth et al. 2004, Galloway et al. 2005, Dubois et al. 2007b, Wright et al. 2007) and may have a sustained effect (Ashcroft et al. 2008, Mascola, Bryson and Agras 2010) that leads to eating disorders such as Anorexia Nervosa or Bulimia Nervosa in young adulthood (Kotler et al. 2001, Marchi and Cohen 1990). According to a nationally representative US study of infants and toddlers, young children consumed similar foods to those consumed by older family members, suggesting that some food preferences develop in the early stages of life and remain until adulthood (Fox et al. 2004, Birch 1998).

Picky eating is a complex concept composed of several types of eating behavior (Shim et al. 2011). Previous studies have identified that caregivers of such picky children have reported various problems in feeding the children, including children eating insufficient amounts, avoiding new foods, unwilling to eat various foods, preferring foods prepared in specific ways, or having a strong preference (like or dislike) for particular foods (Wardle et al. 2001, Davies et al. 2007, Wright et al. 2007, Galloway et al. 2005, Carruth

et al. 1998, Carruth et al. 2004, Jacobi et al. 2003, Mascola et al. 2010).

Eating problems have generally been measured by a simple single question, based on parents' perceptions of feeding difficulty or pickiness, such as 'Is your child a picky eater?' (Carruth et al. 2004, Lee 2013, Jacobi et al. 2003), or by a list of questions about eating behaviors and feeding practices (Galloway et al. 2005, Ashcroft et al. 2008, Davies et al. 2007, Galloway, Lee and Birch 2003, van der Horst 2012). However, the definition of pickiness varies and studies about picky eating often focused on a limited variety of food, food preferences, or food neophobia (Galloway et al. 2005, Shim et al. 2011). Differences in the definitions and measurements of picky eating lead to confusion and problems in interpretation and it is unclear to disentangle concepts of pickiness as perceived by parents (Dovey et al. 2008).

Recently two studies have tried to present a clear definition of picky eating and have characterized children's picky eating behaviors with two attributes based on previously reported aspects of picky eating behaviors: eating small amounts of food and eating a limited variety of foods (Shim et al. 2011, Shim et al. 2013). 'Eating small amounts' refers to consuming insufficient food and 'limited variety' includes 'food neophobia' which refers to avoiding new foods and a 'refusal of specific food groups' as well as a 'preference for a specific food preparation method' which refers to children's likes and dislikes of specific foods and certain recipes for each food (Shim et al. 2011, Shim et al. 2013). The study measured the degree of each picky behavior and the growth in young children at a medical clinic for picky eaters (Shim et al. 2011, Shim et al. 2013). However, an investigation of the prevalence of such behaviors in children at the community level has not been conducted. Furthermore, the influence on dietary intake and its relation to

the healthy growth of children has also not been investigated, either.

2. Purpose of the study

Thus, this study was conducted to measure prevalence of picky eating habits and to examine the effect of picky eating problems on dietary and growth status in early childhood.

Thus, specific aims of the study are as following:

i. To measure the prevalence of picky eating problems among the study subjects

ii. To examine dietary and growth status of picky eaters by perception of caregivers and picky eating behaviors

iii. To assess the association between perception of caregivers and children's picky eating behaviors

II. LITERATURE REVIEW

1. Definition and measurement of picky eating

Picky eating behaviors has been considered as prevalent problems in childhood; however the definition and measurement of picky eating varies in each study. Carruth et al. (2004) and Jacobi et al. (2008) characterized picky eaters as children who refuse certain types of foods that their parents think appropriate or necessary for them and measured it by a single questions based on this definition. Mascola et al. (2010) also used this definition to assess the children's eating behavior with the question of 'Is your child a picky eater? '. In Korea, this single question has been used to estimate child's pickiness (Lee 2013). Dubois et al. (2007b) focused on the children with feeding difficulty who required a different meal from other family members, refused to eat foods or refused to eat any foods.

On the other hands, Galloway et al. (2003) regarded pickiness as an unwillingness to eat unfamiliar foods and measured it by a subscale of the Child Feeding Questionnaire (CFQ), which assessed parental attitudes on child feeding and included three questions: "my child's diet consists of only a few foods", "my child is unwilling to eat many of the foods that our family eats at mealtimes", and "my child is fussy or picky about what she eats". Galloway et al. (2005) considered picky eater as children consuming an inadequate variety of food and assessed it by the subscale of CFQ.

Some traits of picky eating have been used to estimate picky eaters, such as food preference and food neophobia. Although some studies distinguished food neophobia from picky eating, food neophobia has been treated within pickiness. Food neophobia,

the fear or reluctance to new foods, was assessed by the parents' response about the Children's Food Neophobia Scale (CFNS) (Russell and Worsley 2008). The associations between picky eating and food neophobia have widely been reported. Dovey et al. (2008) reviewed the relation between these two constructs and suggested that food neophobia is a part of picky eating behavior, not entirely. Mascola et al. (2010) studied eating behaviors of children related to picky eating; picky eaters significantly consumed low variety of foods, required food prepared in a specific way, had strong likes and dislikes, and had reluctance to eat new foods. These various eating behaviors have also regarded as a characteristic of picky eating.

Pickiness has been sometimes defined as combination of various attributes, as Dovey et al. (2008) suggested picky eating defined as having a limited variety of foods with rejection of foods, consuming inadequate amount of food, and rejecting specific food flavor and texture. In this respects, Wright et al. (2007) assessed eating behaviors with 4 areas: eating problems, which meant "difficulties with your child" with a question of "Do you see our child as having eating problems at present?", eating and feeding behavior, which included mealtime strategies to feed, a management of food refusal, and child's appetite, preferences for food and food types, and drinking pattern. Shim et al. (2011) defined picky eating as a complex concepts which consisted of two constructs, eating small amounts of food and consuming a low variety of food. A limited variety of foods was composed of food neophobia, food rejection, and preference for a specific food preparation method. Shim et al. (2013) also defined picky eating as a complex term and measured it using 4 variables including eating small amounts, which consisted of parents' struggle to eat and child' appetite, neophobic behavior for new foods, which

included unwillingness to eat new foods at home and when offered, refusal of specific food groups, which consisted of questions about 12 food groups, and preference for a specific food preparation method, which consisted of questions about 9 food groups.

2. The influence of picky eating habits on dietary intake in early childhood.

Appropriate dietary intake in childhood is known as an important element of health and growth. WHO growth standards demonstrated that children have similar growth pattern with optimal nutrition and socioeconomic conditions, wherever they lived (Group 2006). Insufficient intakes of nutrients are common reasons of poor growth and growth faltering, especially inadequate energy, protein, and some micronutrients (Goulet 2010). Deficiencies of zinc, iron and vitamin A may result in anorexia and growth retardation and associated with immune function and risk of morbidity (Rivera et al. 2003). Various factors have been suggested to have influence on nutritional status in children, such as family and sociodemographic environment, but also individual factors including individual traits such as temperaments (Kim et al. 2006).

Although the ambiguous definition and measurement of picky eating, this eating habits have been reported as one of the influential factors on children's diet; however there were differences in age and sex. Carruth et al. (2004) reported picky eaters aged between 7 to 8 months consumed significantly less carbohydrate and vitamin C, thiamin, riboflavin, niacin vitamin E, and iron, and picky eaters aged between 9 to 11 months consumed significantly less energy, total fat, and most of micronutrients, except vitamin C, niacin, vitamin E, and iron. Galloway et al. (2005) reported 9-year-old children perceived as picky eaters had lower intake of dietary fiber, vitamin E, and folate. Dubois et al. (2007b) reported picky eaters between 2.5- to 4.5- years-old children consumed less energy, total fats, proteins, but consumed more carbohydrates and proteins ratio from energy. Carruth et al. (1998) , however, reported picky-eater status did not induce

the difference in nutrient intake of children aged 24 to 35 months.

Picky eaters were generally reported to avoid more foods than non-picky eaters (Jacobi et al. 2008). Galloway et al. (2005) reported picky eaters consumed less food groups, except dairy products and meat. Galloway et al. (2003) suggested pickiness of 7-year-old girls were negatively related with vegetable intake. Dubois et al. (2007b) reported similar findings that children who had higher response of picky eating were likely to consume less servings of vegetables, fruits and meat; picky eaters were about one and half times more in consuming 0 – 2 servings of vegetables and fruits and in consuming 0 – 1 servings of meat and alternatives than children who never reported as picky eaters.

These tendencies that picky eaters consumed less nutrients and food groups, especially vegetables and fruits have been also reported in particular picky eating behaviors. Food neophobia was negatively correlated with intakes of vegtables, fruits, and meat (Cooke, Wardle and Gibson 2003). Galloway et al. (2003) suggested food neophobia of 7-year-old girls were negatively related with vegetable intake. Skinner et al. (2002) reported food neophobia of children aged 8 years were positively associated with the numbers of foods which were never tried and dislikes of foods, but negatively related to the food preference. Russell and Worsley (2008) also reported the degree of food neophobia among Australian children aged 2 to 5 years was negatively correlated with the intakes of vegetables, meats and fruits.

3. The influence of picky eating habits on growth status in early childhood.

Insufficient dietary intake induced by picky eating behavior can be a crucial element for poor growth status in childhood. Some studies have been reported the relations between picky eating and growth in various participants. Galloway et al. (2005) reported that 9-year-old girls who perceived as picky eater had less BMI and Body fat. Dubois et al. (2007a) reported similar results that picky eaters were less likely to be overweight, but more likely to be underweight in children aged 4.5 years and to have increasing risk of being underweight in children between 2.5 to 4.5 years old. Two-year-old children who had eating problems had less weight and height (Wright et al. 2007) and more picky eaters aged 32 months on median were underweight than the counterparts (Ekstein, Laniado and Glick 2010). Shim et al. (2013) conducted a study that picky eaters eating small amounts had lower z-scores for height-for-age and weight-for-height in children aged 1 to 5 years and children had no significant difference regarding a limited variety of foods such as neophobic behavior, a refusal of specific food groups and a preference for a specific food preparation method. Studies have suggested younger picky eater have a higher risk of growth retardation. A weight faltering in 12-month-old children was associated with avoidance to eat and the risk of sustained weight faltering for the first year was associated with low appetite and avoidance to eat in infants (Wright, Parkinson and Drewett 2006).

This risk of underweight in early childhood causes the impediment to developing body function and health problems in older children and adulthood. Fox et al. (2004) found food preferences of infants and toddlers aged 9 to 24 months had similar pattern with

those of adolescents and adults, which implied food preferences are established in the early stages of life and continue. And Ashcroft et al. (2008) suggested some eating behaviors including pickiness may stably appear during childhood based on the finding that the behaviors continued from age 4 years to age 11 years. In addition, Marchi and Cohen (1990) suggested Anorexia Nervosa in adolescence may be related to picky eating in early childhood and Kotler et al. (2001) reported the risk of eating disorders such as Anorexia nervosa and Bulimia Nervosa were positively associated with eating conflicts or parents' struggles around meals.

III. METHODS

1. Study subjects

This study is a cross-sectional survey targeting children aged 1 to 5 years old from the Seoul Metropolitan Area of Korea. The recruitment of subjects was conducted with the cooperation of two Community Health Centers in Seoul, Korea between September 2014 and July 2015. Convenience sampling was employed to recruit volunteers by using flyers, public announcements and online announcements at Community Health centers, a pharmacy, and an online caregiver's community. Voluntarily participating primary caregivers of the children were asked to complete the survey questionnaire. Subjects were enrolled after the caregivers were given a full explanation of the purpose and protocols of the research in person. Face to face or telephone interviews, or self-administered surveys, followed by review of the survey by a trained dietitian, were conducted.

Subjects were further excluded if the child had a food allergy or a medical problem that affected food intake. Of 221 children's caregivers who initially volunteered and were eligible for the study, 184 caregivers had complete data and were analyzed for picky eating habits, dietary intake and growth status. The inclusion criteria is shown in figure 1. The Seoul National University Institutional Review Board approved the study protocol (IRB No. 1407/001-034) and all participants provided written informed consent. The characteristics of children who participated in the final analysis are shown in Table 1. Most of children were breastfed and more than half were exclusively breastfed for the first six months of life. They generally lived in well-educated middle-class families. The

growth status of all subjects was in the normal range of weight-for-age, height-for-age, and BMI-for-age. The subjects were divided into two age groups based on the criteria in the previous study which measured picky eaters at three times of age (2 to 3 years old, 4 years old, and 8 years old) due to the difference of eating behaviors (Skinner et al. 2002). The number of children aged 1 to 3 years was 125 and that of older age group was 59.

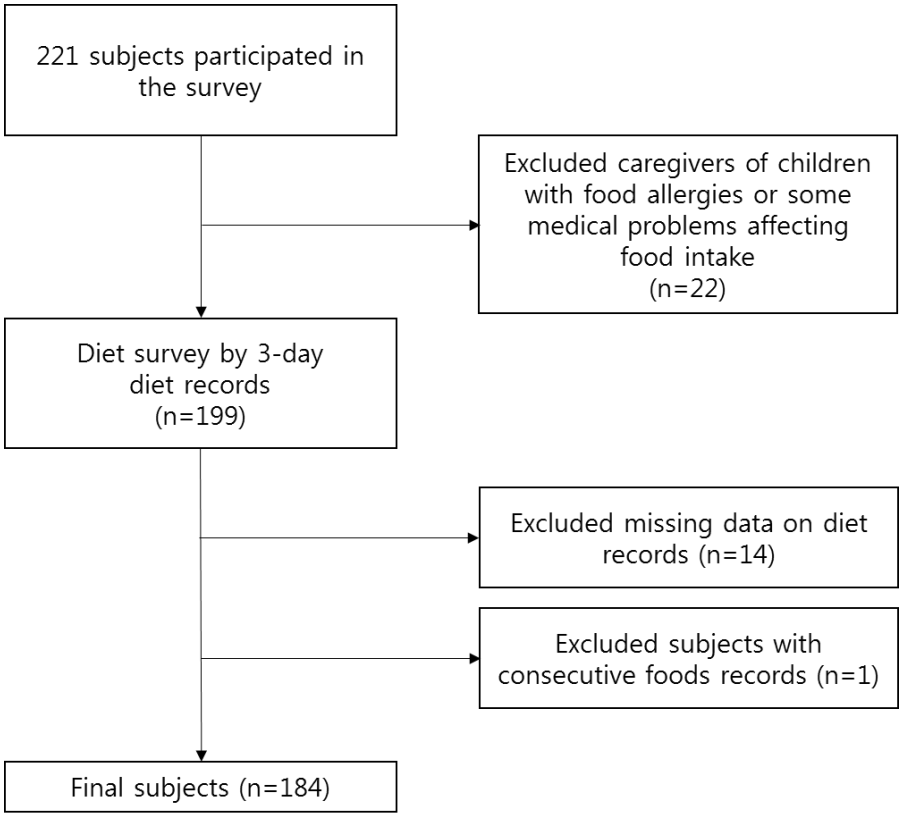

Figure 1. Flow diagram illustrating selection of subjects.

Table 1. Sociodemographic characteristics of children and their caregivers (n=184)

Variables	
	mean ± SD
Age of children (y)	2.8 ± 1.4
Age of caregiver (y)	34.9 ± 3.8
Growth status (z-score)	
Weight for age	0.1 ± 0.8
Height for age	-0.3 ± 1.1
BMI for age	0.3 ± 1.0
	n (%)
Sex of children	90 (48.9)
Infant feeding practice	
Breastfeeding initiation	177 (96.2)
Exclusive breastfeeding under 3 months of life	166 (90.2)
Exclusive breastfeeding under 6 months of life	93 (50.5)
Introduction of complementary foods before 6 months of age	55 (29.9)
Nutrition Plus[b] participation	
Yes	72 (39.1)
No	112 (60.9)
Education level of father	
≤ High school	18 (9.8)
University	137 (74.5)
Graduate school	29 (15.8)
Education level of mother	
≤ High school	29 (15.8)
University	135 (73.4)
Graduate school	20 (10.9)
Household income (10,000 ₩/month)[c]	
≤ 280	76 (41.3)
281 to 390	58 (31.5)
≥ 391	50 (27.2)

[a]All foods except breast milk and formula

[b]A Nutrition supplemental program for women, infant, and children in Korea

[c]Monthly household income was classified using 2nd and 3rd quintiles of the national household income data (Statistics 2014).

2. Measurements

A. Socio-demographic information and childcare environment

A questionnaire investigating the children's eating behavior, child feeding practices and care environment was administered and the data obtained by self-reporting on the part of the caregivers of participating children. The sociodemographic characteristics included information relating to the caregivers such as age, education level of both parents (≤ high school, college graduate, graduate school) and the child's characteristics such as age and sex. Monthly household income was classified using 2nd and 3rd quintiles of the national household income data (Statistics 2014); ≤ ₩ 2,800,000, ₩ 2,810,000 to ₩ 3,900,000, and ≥ ₩ 3,910,000. In addition, Nutrition Plus participation, a nutrition supplemental program for women, infants and children in Korea, and infant feeding practices were investigated.

Infant feeding practice was measured by the duration of breastfeeding, introduction of formula or milk, and introduction of complementary foods. According to the AAP guidelines, it was transformed to binary variables, including breastfeeding initiation, exclusive breastfeeding during the first 3 months and during the first 6 months of life, and early introduction of complementary foods before 6 months of life (Gartner et al. 2005).

B. Picky eating habits

Perception of caregivers about pickiness of children and children's picky eating behaviors were assessed by using survey questions based on the concepts from previous studies (Shim et al. 2011, Shim et al. 2013). Caregivers were asked to respond to the frequency of each question using a five-point response scale of 1 (never or very bad) to 5 (always or very good). The higher scores demonstrated greater picky eating habits, so the reverse-described questions were transposed.

Picky eating habits were measured by perception of caregivers and picky eating behaviors of child.

Questions on perception of caregivers were:

i. Feeding difficulty, with the question of "Do you have any difficulty in feeding your child?"

ii. Pickiness of child, with the question of "Do you think your child is picky eater?"

The four specific children's picky eating behaviors and questions were:

i. Eating small amounts, with the question of "How often do you attempt to persuade your child to eat a food?", and two reversed-described questions of "In general, at the end of the meal how often has your child eaten the amount you think he/she should eat?" and "Does your child have a good appetite?"

ii. Neophobic behavior, with two reverse-described questions of "How often does your child try new and unfamiliar foods at home?", and "How willing is your child to enjoy new and unfamiliar food when offered?"

iii. Refusal of specific food groups, using the question of "How often does your

child refuse the following foods -beans, vegetables, mushrooms, seaweeds, meat, fish, shrimp, shellfish, eggs, fruits, milk, and yogurt?"

iv. Preference for a specific food preparation method, with the question of "Does your child eat any of the following foods only if prepared in a specific way beans, vegetables, mushrooms, seaweeds, meat, fish, shrimp, shellfish, and eggs?"

For a child who had never tried certain food groups such as shrimps or shellfish yet, the response was treated as a missing value. Children whose mean score of responses was > 3 were classified as 'picky eaters' for 'eating small amounts' and 'neophobic behavior'. The internal consistency of items on these constructs was measured using the Cronbach's coefficient α (α = 0.80 for 'eating small amounts' and α = 0.73 for 'neophobic behavior'). Refusing each food group was determined by response score > 3. Children who refused more than two food groups were classified as picky eaters as the mean number of refused food groups was 1.8. Children with a preference for a specific food preparation method in any food group were categorized as picky eaters due to the mean number of picky eating food groups (1.2).

C. Dietary intakes

Non-consecutive 3-day diet records were used to collect the dietary intake data of each subject, which included 1 weekend day or holiday to capture day of the week variation in food intake. To minimize errors in portion size, the caregivers were asked to record the intake amount by using two dimensional measurement tools of circles and rulers, spoons, and standardized cups. The protocol for coding diet records had been prepared by a research dietitian supervisor at the beginning of the study. Based on the protocol, trained dietitian interviewers reviewed the data by telephone interview.

For children who were still being breastfed, the intake of breastmilk was assessed according to the reported feeding time; the amount being fed was considered to be 1 fl. oz. (29.6 mL) for every 5 min (Fisher et al. 2008). In cases where a breast pump used, the recorded volume was regarded as the actual intake.

All dietary data were converted to nutrient intake by using DES-KOREA (Diet Evaluation System, 2011) software. Mean daily intake, energy distribution for macronutrients, and nutrient density (intake/ 1000 kcal of energy) for micronutrients, total dietary fiber, and cholesterol were evaluated.

D. Growth status

Anthropometric data of current heights and weights were measured at the local hospital or community health center at the survey period. Then the data were collected by mail and reviewed by the research dietitian. Confirmation was made through telephone interviews. The height data of children aged ≤ 24 months were converted to length by adding 0.7 cm, as WHO Child growth standards suggest (Group 2006).

Data of height/length and weight were converted to z-scores of weight-for-age, height-for-age (length-for-age), and BMI-for-age, compared with the WHO Child Growth Standards for 0-60 months (Group 2006) and the WHO Growth Reference Data for 61-228 months (Onis et al. 2007).

3. Statistical analysis

The data of sociodemographic characteristics and the distribution of picky eating habits were presented as numbers and proportions for categorical variables or as means and standard deviations for numeric variables. Potential compounding factors were examined by Pearson's chi-square test for categorical variables and Student's t-test for continuous variables.

The differences in nutrient intake and z-scores of growth indices between picky eaters and non-picky eaters in each construct for perception of caregivers and specific behaviors were tested by ANCOVA using the General Linear Model (GLM) to adjust for sociodemographic characteristics (Margetts and Nelson 1997).

The association between two variables of perception of caregivers about pickiness was assessed by Pearson's chi-square test. Associations between perception of caregivers and specific picky eating behaviors were compared by Pearson's chi-square test and Pearson's correlation analysis.

All the statistical analyses were performed using SAS software (ver. 9.3, SAS Institute INC, Cary, NC) and the statistical significance was determined at 0.05.

IV. RESULTS

1. Distribution of picky eaters among the study subjects

The results of the reported prevalence of picky eaters are shown in Table 2. The highest mean response was shown in 'neophobic behavior' of children and the lowest appeared in 'refusal of specific food groups'. The prevalence of picky eaters for each construct is shown in figure 2. Among children's picky eating behaviors, the most prevalent behavior was the 'preference for a specific food preparation method' and the least prevalent behavior was 'eating small amounts'. Picky eaters who perceived to have 'feeding difficulty' and 'pickiness' were much smaller than children with picky eating behaviors. The prevalence of 'neophobic behavior' in older children aged 4 to 5 years were significantly higher than that in younger children. The younger children had tendency to eat small amount of food, however, not significant.

The proportion of picky eaters for each food groups is shown in figure 3 and figure 4. The most refused food groups were shellfish and beans and the least refused food groups were fish, fruits, and eggs. Children required food to be prepared in a certain way mainly for shellfish and beans. Only 3% of children required eggs to be prepared in a certain way. Fish was not likely to be refused to eat; however it was required to be prepared in a certain way.

Table 2 . Distribution of the responses on picky eating questions (n=184)

Constructs	Response[a]				
	1	2	3	4	5
Perception of caregivers					
Feeding difficulty					
Do you have any difficulty in feeding your child?	37 (20.1)	49 (26.6)	50 (27.2)	29 (15.8)	19 (10.3)
Pickiness					
Do you think your child is picky eater?	39 (21.2)	50 (27.2)	51 (27.7)	23 (12.5)	21 (11.4)
Picky eating behaviors of children					
Eating small amounts					
In general, at the end of the meal how often has your child eaten the amount you think he/she should eat?	11 (6.0)	19 (10.3)	52 (28.3)	60 (32.6)	42 (22.8)
How often do you attempt to persuade your child to eat a food?	31 (16.9)	37 (20.1)	47 (25.5)	34 (18.5)	35 (19.0)
Does your child have a good appetite?	7 (3.8)	23 (12.5)	59 (32.1)	52 (28.3)	43 (23.4)
Neophobic behavior					
How often does your child try new and unfamiliar foods at home?	9 (4.9)	35 (19)	65 (35.3)	44 (23.9)	31 (16.9)
How willing is your child to enjoy new and unfamiliar food when offered?	19 (10.3)	40 (21.7)	61 (33.2)	49 (26.6)	15 (8.2)

[a]1=never or very bad, 3=often or normal, 5=always or very good

Table 2. Distribution of picky eaters (n=184) (continued)

Constructs	Response[a]				
	1	2	3	4	5
Picky eating behaviors of children					
Refusal of specific food groups					
How often does your child refuse following foods?					
Beans[b]	61 (33.3)	26 (14.2)	37 (20.2)	30 (16.4)	29 (15.9)
Vegetables	61 (33.2)	49 (26.6)	33 (17.9)	28 (15.2)	13 (7.1)
Mushrooms	60 (32.6)	43 (23.4)	41 (22.3)	19 (10.3)	21 (11.4)
Seaweeds	72 (39.1)	54 (29.4)	27 (14.7)	20 (10.9)	11 (6.0)
Meat	110 (59.8)	36 (19.6)	22 (12.0)	11 (6.0)	5 (2.7)
Fish	134 (72.8)	27 (14.7)	16 (8.7)	3 (1.6)	4 (2.2)
Shrimp[b]	89 (48.9)	27 (14.8)	32 (17.6)	18 (9.9)	16 (8.8)
Shellfish[b]	53 (29.8)	25 (14.0)	33 (18.5)	27 (15.2)	40 (22.5)
Eggs	139 (75.5)	27 (14.7)	10 (5.4)	3 (1.6)	5 (2.7)
Fruits	138 (75.0)	29 (15.8)	10 (5.4)	5 (2.7)	2 (1.1)
Milk[b]	127 (70.2)	24 (13.3)	17 (9.4)	5 (2.8)	8 (4.4)
Yogurt[b]	149 (81.4)	17 (9.3)	7 (3.8)	6 (3.3)	4 (2.2)
Preference for a specific food preparation method					
Does your child eat any of following foods only if prepared a specific way?					
Beans[b]	84 (45.9)	31 (16.9)	28 (15.3)	20 (10.9)	20 (10.9)
Vegetables	68 (37.0)	38 (20.7)	42 (22.8)	23 (12.5)	13 (7.1)
Mushrooms	86 (46.7)	27 (14.7)	45 (24.5)	11 (6.0)	15 (8.2)
Seaweeds	92 (50.0)	29 (15.8)	45 (24.5)	10 (5.4)	8 (4.4)
Meat	101 (54.9)	30 (16.3)	35 (19.0)	13 (7.1)	5 (2.7)
Fish	128 (69.6)	23 (12.5)	28 (15.2)	5 (2.7)	0 (0.0)
Shrimp[b]	100 (55.0)	21 (11.5)	37 (20.3)	13 (7.1)	11 (6.0)
Shellfish[b]	75 (42.1)	31 (17.4)	25 (14.0)	20 (11.2)	27 (15.2)
Eggs	123 (66.9)	28 (15.2)	27 (14.7)	5 (2.7)	1 (0.5)

[a] 1=never or very bad, 3=often or normal, 5=always or very good

[b]The number of children who refused each food group; 183 children for Beans, 182 children for Shrimp, 178 children for Shellfish, 181 children for Milk, 183 children for Yogurt

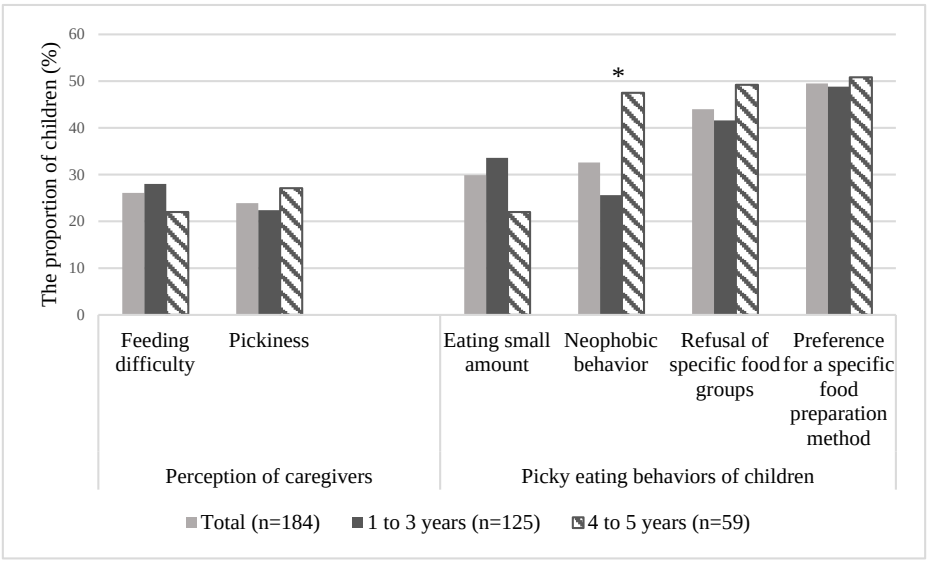

Figure 2. The proportion of picky eaters who usually had picky eating habits by age groups

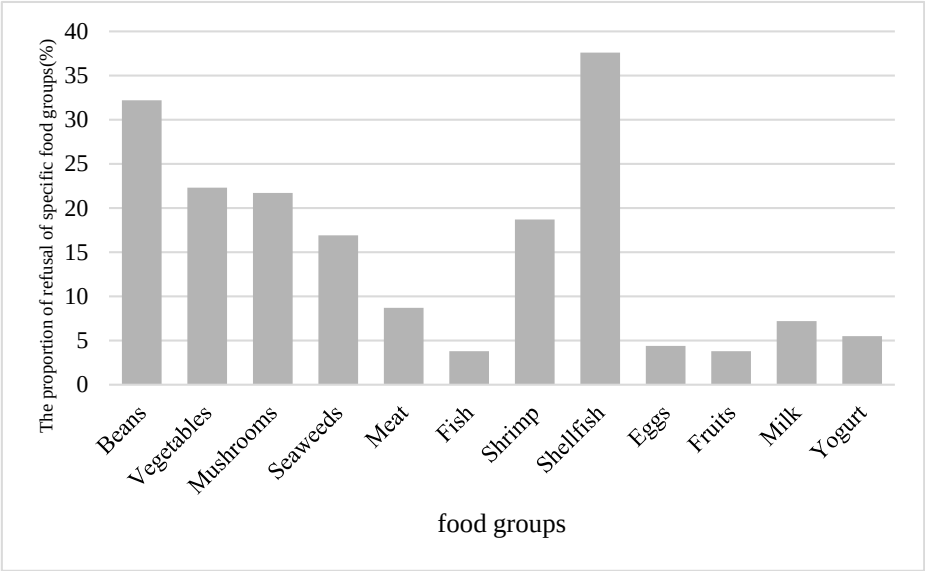

Figure 3. The proportion of children who usually refused a specific food group for each food group

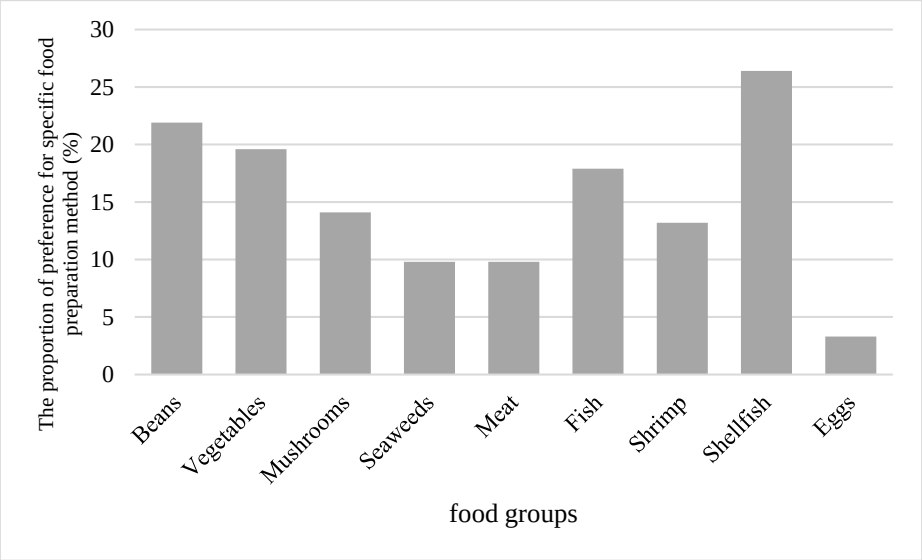

Figure 4. The proportion of children who usually required to prepare foods in a certain way for each food group

2. Sociodemographic characteristics of picky eaters

A. Picky eaters assessed by perception of caregivers

The sociodemographic characteristics of picky eaters with perception of caregivers about 'feeding difficulty' and 'pickiness' had no difference compared those of non-picky eaters, except education level of mother (Table 3).

B. Picky eaters assessed by picky eating behaviors

There were differences of children's mean age with 'neophobic behavior'. Education level of both parents was difference between picky eaters and non-picky eaters with picky eating behaviors. There were no difference of infant feeding practices, participation in Nutrition Plus, and monthly household income (Table 4).

Table 3 . Sociodemographic characteristics of picky eaters assessed by perception of caregivers (n=184)

	Feeding difficulty			Pickiness		
	Yes (n=48)	No (n=136)	$p^{1)}$	Yes (n=44)	No (n=140)	$p^{1)}$
			mean ± SD			
Age of children (y)	2.7 ± 1.3	2.8 ± 1.4	0.4615	3.1 ± 1.4	2.7 ± 1.4	0.1314
Age of caregiver (y)	35.4 ± 5.0	34.8 ± 3.2	0.3650	35.7 ± 5.4	34.7 ± 3.1	0.1432
			n (%)			
Sex of children % Boy	52.1	47.8	0.6093	20 (45.5)	70 (50.0)	0.5988
Infant feeding practice						
Breastfeeding initiation	47 (26.6)	130 (73.5)	0.6783	42 (23.7)	135 (76.3)	0.6730
Exclusive breastfeeding under 3 months	41 (24.7)	125 (75.3)	0.2561	39 (23.5)	127 (76.5)	0.6857
Exclusive breastfeeding under 6 months	22 (23.74)	71 (76.3)	0.4477	20 (21.5)	73 (78.5)	0.4389
Introduction of complementary foods[a] before 6 months of age	17 (30.9)	38 (60.1)	0.3307	13 (23.6)	42 (76.4)	0.9542
Nutrition Plus[b] participation						
Yes	19 (26.4)	53 (73.6)	0.9404	19 (26.4)	53 (73.6)	0.5279
No	29 (25.9)	83 (74.1)		25 (22.3)	87 (77.7)	
Education level of father						
≤ High school	3 (16.7)	15 (83.3)		4 (22.2)	14 (77.8)	
University	34 (24.8)	103 (75.2)	0.2173	32 (23.4)	105 (76.6)	0.8752
Graduate school	11 (37.9)	18 (62.1)		8 (27.6)	21 (72.4)	
Education level of mother						
≤ High school	10 (34.5)	19 (65.5)		13 (44.8)	16 (55.2)	
University	33 (24.4)	102 (75.6)	0.5322	25 (18.5)	110 (81.5)	0.0085
Graduate school	5 (25.0)	15 (75.0)		6 (30.0)	14 (70.0)	
Household income (10,000 ₩/month)						
≤ 280	23 (30.3)	53 (69.7)		23 (30.3)	53 (69.7)	
281 to 390	14 (24.1)	44 (75.9)	0.5393	11 (19.0)	47 (81.0)	0.2363
≥ 391	11 (22.0)	39 (78.0)		10 (20.0)	40 (80.0)	

[a] All foods except breast milk and formula; [b] A Nutrition supplemental program for women, infant, and children in Korea; [c]Monthly household income was classified using 2nd and 3rd quintiles of the national household income data (Statistics 2014).

[1)] Unadjusted p-value by Student's t-test for continuous variables and Pearson's chi-square test or Fisher's exact test for categorical variables

Table 4 -1. Sociodemographic characteristics of picky eaters assessed by picky eating behaviors: eating small amounts and neophobic behavior (n=184)

Variables	Eating small amounts			Neophobic behavior		
	Yes (n=55)	No (n=129)	$p^{1)}$	Yes (n=60)	No (n=124)	$p^{1)}$
	mean ± SD					
Age of children (y)	2.5 ± 1.5	2.9 ± 1.3	0.0685	3.3 ± 1.3	2.6 ± 1.4	0.0011
Age of caregiver (y)	35.3 ± 5.0	34.8 ± 3.1	0.4257	35.1 ± 4.2	34.9 ± 3.5	0.6388
	n (%)					
Sex of children, % Boy	51.2	43.6	0.3498	58.3	44.4	0.0754
Infant feeding practice						
Breastfeeding initiation	54 (30.5)	123 (69.5)	0.6762	57 (32.2)	120 (67.8)	0.6843
Exclusive breastfeeding under 3 months	50 (30.1)	116 (69.9)	0.8366	51 (30.7)	115 (69.3)	0.0975
Exclusive breastfeeding under 6 months	26 (28.0)	67 (72.0)	0.5623	29 (31.2)	64 (38.8)	0.6766
Introduction of complementary foods[a] before 6 months of age	17 (30.9)	38 (69.1)	0.8439	17 (30.9)	38 (69.1)	0.7481
Nutrition Plus[b] participation						
Yes	24 (33.3)	48 (66.7)	0.4135	20 (27.8)	52 (72.2)	0.2624
No	31 (66.7)	81 (33.3)		40 (72.2)	72 (27.8)	
Education level of father						
≤ High school	8 (44.4)	10 (55.6)		2 (11.1)	16 (88.9)	
University	35 (25.5)	102 (74.5)	0.0872	53 (38.7)	84 (61.3)	0.0100
Graduate school	12 (41.4)	17 (58.6)		5 (17.2)	24 (82.7)	
Education level of mother						
≤ High school	16 (55.2)	13 (44.8)		13 (44.8)	16 (55.2)	
University	105 (77.8)	30 (22.2)	0.0006	40 (29.6)	95 (70.4)	0.2270
Graduate school	9 (45.0)	11 (55.0)		7 (35.0)	13 (65.0)	
Household income (10,000 ₩/month)[c]						
≤ 280	29 (38.2)	47 (61.8)		27 (35.5)	49 (64.5)	
281 to 390	13 (22.4)	45 (77.6)	0.1115	19 (32.8)	39 (67.2)	0.6776
≥ 391	13 (26.0)	37 (74.0)		14 (28.0)	36 (72.0)	

[a] All foods except breast milk and formula[b] A Nutrition supplemental program for women, infant, and children in Korea; [c]Monthly household income was classified using 2nd and 3rd quintiles of the national household income data (Statistics 2014).

[1)] Unadjusted p-value by Student's t-test for continuous variables and Pearson's chi-square test or Fisher's exact test for categorical variables

Table 4-2. Sociodemographic characteristics of picky eaters assessed by picky eating behaviors: refusal of specific food groups and preference for a specific food preparation method (n=184)

Variables	Refusal of specific food groups			Preference for a specific food preparation method		
	≥ 2 (n=81)	0 - 1 (n=103)	$p^{1)}$	≥ 1 (n=91)	0 (n=93)	$p^{1)}$
				mean ± SD		
Age of children (y)	3.0 ± 1.3	2.6 ± 1.4	0.0914	2.9 ± 1.4	2.6 ± 1.4	0.2096
Age of caregiver (y)	35.2 ± 4.5	34.7 ± 3.0	0.3414	35.0 ± 3.8	34.8 ± 3.8	0.7114
				n (%)		
Sex of children, % Boy	50.6	47.6	0.6817	46.2	51.6	0.4589
Infant feeding practice						
Breastfeeding initiation	78 (44.1)	99 (55.9)	1.0000	89 (50.3)	88 (49.7)	0.4442
Exclusive breastfeeding under 3 months	72 (43.4)	94 (56.6)	0.5906	85 (51.2)	81 (48.8)	0.2144
Exclusive breastfeeding under 6 months	39 (41.9)	54 (58.1)	0.5644	46 (49.5)	47 (50.5)	0.9987
Introduction of complementary foods[a] before 6 months of age	23 (41.8)	32 (58.2)	0.6942	23 (41.8)	32 (58.2)	0.1760
Nutrition Plus[b] participation						
Yes	29 (40.3)	43 (59.7)	0.4121	32 (44.4)	40 (55.6)	0.2756
No	52 (59.7)	60 (40.3)		59 (55.6)	53 (44.4)	
Education level of father						
≤ High school	7 (38.9)	11 (61.1)		12 (66.7)	6 (33.3)	
University	64 (46.7)	73 (53.3)	0.4346	71 (51.8)	66 (48.2)	0.0184
Graduate school	10 (34.5)	19 (65.5)		8 (27.6)	21 (72.4)	
Education level of mother						
≤ High school	19 (65.5)	10 (34.5)		18 (62.1)	11 (37.9)	
University	53 (39.3)	82 (60.7)	0.0353	65 (48.2)	70 (51.8)	0.2653
Graduate school	9 (45.0)	11 (55.0)		8 (40.0)	12 (60.0)	
Household income (10,000 ₩/month)						
≤ 280	31 (40.8)	45 (59.2)		33 (43.4)	43 (56.6)	
281 to 390	29 (50.0)	29 (50.0)	0.5362	34 (58.6)	24 (41.4)	0.2124
≥ 391	21 (42.0)	29 (58.0)		24 (48.0)	26 (52.0)	

[a] All foods except breast milk and formula [b] A Nutrition supplemental program for women, infant, and children in Korea; [c]Monthly household income was classified using 2nd and 3rd quintiles of the national household income data (Statistics 2014).

[1)] Unadjusted p-value by Student's t-test for continuous variables and Pearson's chi-square test or Fisher's exact test for categorical variables

3. Dietary intake of picky eaters

Dietary intake of picky eaters and non-picky eaters by perception of caregivers are shown in Table 5. Children with 'feeding difficulty' had lower intake of energy and some micronutrients including iron and vitamin E and they consumed low nutrient density of total dietary fiber. Children with 'pickiness' also consumed less energy and most of micronutrients, except calcium and vitamin C, and they had lower intake of iron and niacin per 1000 kcal of energy than the counterparts.

The dietary intake of picky eaters, as compared to non-picky eaters, vary with each eating behavior (Table 6). Children considered to be 'eating small amounts' had a significantly lower intake of energy and all micronutrients, except calcium. There was no significant difference in the proportion of energy in all the macronutrients but there was a difference in the nutrient density of the micronutrients between picky eaters and non-picky eaters. Children with 'neophobic behavior' consumed greater amounts of cholesterol in both nutrient intake and nutrient density but less dietary fiber per 1000 kcal of energy intake than children without 'neophobic behavior'. Picky eaters with a 'refusal of specific food groups' consumed less micronutrients, except calcium and niacin. There was also a significant difference in nutrient density with some micronutrients. The 'preference for a specific food preparation method' was related to lower intakes of iron, vitamin A, and vitamin E, and lower nutrient density of vitamin E.

Table 5 . Dietary intake of picky eaters assessed by perception of caregivers (n=184)

	Feeding difficulty			Pickiness		
	Yes (n=48)	No (n=136)	$p^{1)}$	Yes (n=44)	No (n=140)	$p^{1)}$
	mean ± SD					
Mean daily dietary intake						
Energy (kcal)	1155.4 ± 343.6	1330.5 ± 348.6	0.0022	1177.2 ± 375.8	1318.6 ± 342.5	0.0024
Protein (% Energy)	15.9 ± 2.5	15.9 ± 2.0	0.9076	15.9 ± 2.3	15.9 ± 2.1	0.7590
Lipid (% Energy)	24.3 ± 4.9	23.4 ± 4.9	0.3755	23.6 ± 5.0	23.6 ± 4.9	0.8614
Carbohydrate (% Energy)	59.8 ± 6.2	60.7 ± 5.7	0.4325	60.5 ± 5.8	60.4 ± 5.8	0.7937
Calcium (mg)	398.2 ± 139.9	453 ± 214.4	0.0670	393.3 ± 137.7	452.9 ± 212.8	0.0777
Iron (mg)	7.8 ± 2.7	9.8 ± 4.2	0.0037	7.8 ± 3.2	9.7 ± 4.1	0.0004
Vit. A (μg RE)	390.5 ± 202.5	457.3 ± 237.7	0.0706	383.4 ± 208.7	457.6 ± 234.7	0.0449
Thiamin (mg)	0.6 ± 0.2	0.8 ± 0.3	0.0034	0.7 ± 0.3	0.8 ± 0.3	0.0233
Riboflavin (mg)	0.9 ± 0.3	1.0 ± 0.3	0.0517	0.9 ± 0.3	1.0 ± 0.3	0.0185
Niacin (mg)	7.6 ± 2.8	9.3 ± 3.3	0.0022	7.7 ± 3.1	9.2 ± 3.2	0.0006
Vit. C (mg)	82.1 ± 58.7	91.7 ± 59.7	0.3824	85.3 ± 66.6	90.4 ± 57.2	0.2028
Vit. E (mg)	5.9 ± 2.1	7.1 ± 2.5	0.0017	5.9 ± 2.1	7.1 ± 2.5	0.0014
Total Dietary Fiber (g)	10.1 ± 3.8	13.0 ± 4.8	0.0002	10.8 ± 4.5	12.7 ± 4.7	0.0039
Cholesterol (mg)	248.8 ± 146.5	274.1 ± 128.9	0.3167	251.6 ± 154.8	272.5 ± 126.7	0.2189
Nutrient density (intake/1000 kcal)						
Calcium (mg)	357 ± 115.8	338.8 ± 111.2	0.4385	346.6 ± 108.3	342.6 ± 114	0.5455
Iron (mg)	6.8 ± 1.5	7.4 ± 2.8	0.2574	6.6 ± 1.4	7.4 ± 2.7	0.0378
Vit. A (μg RE)	354.2 ± 191.6	346.1 ± 164.8	0.8238	334.5 ± 172.7	352.5 ± 171.7	0.6903
Thiamin (mg)	0.6 ± 0.1	0.6 ± 0.1	0.3468	0.6 ± 0.1	0.6 ± 0.1	0.7391
Riboflavin (mg)	0.8 ± 0.2	0.8 ± 0.2	0.3942	0.8 ± 0.1	0.8 ± 0.2	0.8718
Niacin (mg)	6.5 ± 1.3	7.0 ± 1.5	0.1861	6.4 ± 1.1	7.0 ± 1.5	0.0191
Vit. C (mg)	71.6 ± 37.5	69.1 ± 40.9	0.7173	71.8 ± 41.5	69.1 ± 39.6	0.8496
Vit. E (mg)	5.1 ± 1.0	5.3 ± 1.2	0.2151	5.1 ± 0.8	5.4 ± 1.3	0.1567
Total Dietary Fiber (g)	8.7 ± 2.1	9.7 ± 2.5	0.0215	9.2 ± 2.6	9.6 ± 2.4	0.2769
Cholesterol (mg)	213.4 ± 112.7	207.1 ± 85.7	0.6416	211.6 ± 116.1	207.8 ± 85.2	0.8346

[1)] By ANCOVA, adjusted for age, sex, and education level of both parents

Table 6 -1. Dietary intake of picky eaters assessed by picky eating behaviors: eating small amounts and neophobic behavior (n=184)

	Eating small amounts			Neophobic behavior		
	Yes (n=55)	No (n=129)	$p^{1)}$	Yes (n=60)	No (n=124)	$p^{1)}$
	mean ± SD					
Mean daily dietary intake						
Energy (kcal)	1154.9 ± 340.0	1340.2 ± 347.7	0.0005	1298.6 ± 393.3	1278.1 ± 336.2	0.6959
Protein (% Energy)	15.9 ± 2.5	15.9 ± 2.0	0.8880	16.4 ± 2.4	15.7 ± 2	0.0745
Lipid (% Energy)	23.6 ± 4.6	23.6 ± 5.1	0.4794	23.8 ± 5.5	23.5 ± 4.6	0.4390
Carbohydrate (% Energy)	60.4 ± 5.7	60.5 ± 5.9	0.5902	59.8 ± 6.3	60.8 ± 5.6	0.1876
Calcium (mg)	416.0 ± 146.1	448.3 ± 217.2	0.2252	440.4 ± 209.4	437.8 ± 194.3	0.3546
Iron (mg)	7.9 ± 3.0	9.9 ± 4.2	0.0073	8.9 ± 3.2	9.5 ± 4.2	0.0938
Vit. A (μg RE)	392.6 ± 204.6	460.0 ± 238.5	0.0370	382.3 ± 187.1	467.7 ± 244.5	0.0859
Thiamin (mg)	0.7 ± 0.2	0.8 ± 0.3	0.0116	0.8 ± 0.3	0.7 ± 0.2	0.5680
Riboflavin (mg)	0.9 ± 0.3	1.0 ± 0.3	0.0072	1.0 ± 0.3	1.0 ± 0.3	0.6564
Niacin (mg)	7.5 ± 2.8	9.4 ± 3.3	0.0018	8.7 ± 3.8	8.9 ± 2.9	0.2177
Vit. C (mg)	77.4 ± 54.5	94.2 ± 60.9	0.0380	83.1 ± 63.6	92.2 ± 57.4	0.1119
Vit. E (mg)	5.9 ± 1.9	7.2 ± 2.6	0.0017	6.7 ± 2.7	6.8 ± 2.3	0.4977
Total Dietary Fiber (g)	10.6 ± 4.3	13.0 ± 4.7	0.0122	12.0 ± 5.3	12.4 ± 4.4	0.1032
Cholesterol (mg)	235.6 ± 150.1	281.1 ± 124.3	0.0210	294.9 ± 148.9	254.2 ± 124.3	0.0322
Nutrient density (intake/1000 kcal)						
Calcium (mg)	370.7 ± 113.0	331.9 ± 110.5	0.2044	336.4 ± 102.4	347 ± 117.1	0.2556
Iron (mg)	6.9 ± 1.5	7.4 ± 2.8	0.2711	6.9 ± 1.4	7.4 ± 2.9	0.1159
Vit. A (μg RE)	349.4 ± 172.0	347.7 ± 172.2	0.4670	301.0 ± 150.5	371.0 ± 177.1	0.1554
Thiamin (mg)	0.6 ± 0.1	0.6 ± 0.1	0.3715	0.6 ± 0.1	0.6 ± 0.1	0.1805
Riboflavin (mg)	0.8 ± 0.2	0.8 ± 0.2	0.6383	0.8 ± 0.1	0.8 ± 0.2	0.2690
Niacin (mg)	6.5 ± 1.3	7.0 ± 1.5	0.0758	6.6 ± 1.4	7.0 ± 1.4	0.0683
Vit. C (mg)	67.8 ± 34.8	70.6 ± 42.0	0.2579	64.4 ± 41.5	72.4 ± 39.1	0.1617
Vit. E (mg)	5.1 ± 0.9	5.4 ± 1.3	0.0818	5.1 ± 1.0	5.4 ± 1.2	0.3808
Total Dietary Fiber (g)	9.1 ± 2.6	9.6 ± 2.4	0.4781	9.1 ± 2.3	9.7 ± 2.5	0.0167
Cholesterol (mg)	200.9 ± 112.8	212.1 ± 83.7	0.2171	230.1 ± 113.1	198.4 ± 80.4	0.0052

[1)] By ANCOVA, adjusted for age, sex, and education level of both parents

Table 6-2. Dietary intake of picky eaters assessed by picky eating behaviors: eating small amounts and neophobic behavior (n=184)

	Refusal of specific food groups			Preference for a specific food preparation method		
	≥ 2[1] (n=81)	0 – 1[1] (n=103)	*p*[2]	≥ 1[1] (n=91)	0[1] (n=93)	*p*[1]
				mean ± *SD*		
Mean daily dietary intake						
Energy (kcal)	1260.6 ± 364.0	1303.9 ± 348.1	0.2210	1265.0 ± 360.5	1304.2 ± 350.2	0.1273
Protein (% Energy)	15.9 ± 2.2	15.9 ± 2.2	0.8004	16.1 ± 2.3	15.7 ± 2	0.4553
Lipid (% Energy)	23.7 ± 5.2	23.6 ± 4.7	0.6578	23.4 ± 5.3	23.8 ± 4.5	0.8095
Carbohydrate (% Energy)	60.4 ± 6.1	60.5 ± 5.6	0.7830	60.5 ± 6.3	60.4 ± 5.3	0.9370
Calcium (mg)	404.2 ± 157.3	465.8 ± 223.2	0.0919	411.1 ± 162.4	465.6 ± 226.5	0.0705
Iron (mg)	8.7 ± 3.1	9.8 ± 4.5	0.0198	8.8 ± 3.2	9.7 ± 4.6	0.0146
Vit. A (μg RE)	385.6 ± 186.9	482.5 ± 252.3	0.0064	404.4 ± 198.9	474.6 ± 253.8	0.0231
Thiamin (mg)	0.7 ± 0.3	0.8 ± 0.3	0.0367	0.7 ± 0.3	0.7 ± 0.3	0.1562
Riboflavin (mg)	0.9 ± 0.3	1.0 ± 0.3	0.0444	0.9 ± 0.3	1.0 ± 0.3	0.1868
Niacin (mg)	8.6 ± 3.4	9.1 ± 3.1	0.1640	8.8 ± 3.3	9.0 ± 3.2	0.1754
Vit. C (mg)	81.6 ± 56.6	95.2 ± 61.2	0.0274	88.6 ± 66.9	89.8 ± 51.5	0.4510
Vit. E (mg)	6.2 ± 2.2	7.3 ± 2.6	0.0020	6.4 ± 2.2	7.2 ± 2.6	0.0088
Total Dietary Fiber (g)	11.5 ± 4.6	12.8 ± 4.7	0.0110	12.0 ± 4.8	12.5 ± 4.6	0.0980
Cholesterol (mg)	256.0 ± 137.5	276.5 ± 130.8	0.4366	262.9 ± 134.7	272.0 ± 133.5	0.4931
Nutrient density (intake/1000 kcal)						
Calcium (mg)	326.8 ± 102.6	356.7 ± 118.3	0.3166	327.5 ± 92.9	359.2 ± 127.1	0.1935
Iron (mg)	6.9 ± 1.4	7.5 ± 3.1	0.0524	7.0 ± 1.5	7.5 ± 3.2	0.0696
Vit. A (μg RE)	314.8 ± 154.3	374.5 ± 180.6	0.0514	325.4 ± 145.7	370.5 ± 191.9	0.1247
Thiamin (mg)	0.6 ± 0.1	0.6 ± 0.1	0.0335	0.6 ± 0.1	0.6 ± 0.1	0.6568
Riboflavin (mg)	0.7 ± 0.1	0.8 ± 0.2	0.1702	0.7 ± 0.1	0.8 ± 0.2	0.6353
Niacin (mg)	6.7 ± 1.4	7.0 ± 1.4	0.3064	6.9 ± 1.4	6.8 ± 1.5	0.7212
Vit. C (mg)	65.4 ± 37.7	73.2 ± 41.5	0.0769	69.3 ± 42	70.2 ± 38.0	0.6559
Vit. E (mg)	4.9 ± 1.0	5.6 ± 1.3	0.0008	5.0 ± 0.9	5.5 ± 1.3	0.0164
Total Dietary Fiber (g)	9.0 ± 2.3	9.8 ± 2.5	0.0074	9.4 ± 2.4	9.5 ± 2.5	0.3655
Cholesterol (mg)	202.2 ± 99.4	213.9 ± 88.1	0.6510	206.1 ± 94.4	211.4 ± 92.5	0.7057

[1] The number of food groups

[2] By ANCOVA, adjusted for age, sex, and education level of both parents

4. Growth status of picky eaters

As shown in table 7, perception of caregivers was related to growth status of children. 'Feeding difficulty' were related to the lower z-scores for weight-for-age and BMI-for age and 'pickiness' were related to the lower z-scores for weight-for-age and height-for-age. These tendency varied in different age groups. One- to three- year-old children who perceived as having 'feeding difficulty' and 'pickiness' had lower z-score only for weight-for-age; however, older children had lower growth status, except BMI-for-age of children with pickiness.

The growth status of picky eaters who had each behavior is compared in Table 8. Picky eaters 'eating small amounts' had a lower z-score for all growth indicators than non-picky eaters, except height-for-age. There were no significant differences in growth indicators between picky and non- picky eaters for 'neophobic behavior' and 'refusal of specific food groups'. Children with a 'preference for a specific food preparation method' had a higher z-score for height-for-age than their counterparts. Picky eaters 'eating small amounts', aged 4 to 5 years, had a significantly lower growth status with respect to all the indicators. Picky eaters with 'refusal of specific food groups' were related with lower height-for-age in this age group. Younger children had no significant differences in growth indicators in relation to all the picky eating behaviors, but picky eaters with 'neophobic behavior' were likely to have a lower z-score for height-for-age ($p = 0.0657$) and higher z-score for BMI-for-age ($p = 0.0575$).

Table 7 . Difference of growth status between picky eaters and non-picky eaters with perception of caregivers

Growth status (z-score)[1)]	Feeding difficulty			Pickiness		
Total subjects (n=184)	Yes (n=48)	No (n=136)	$p^{2)}$	Yes (n=44)	No (n=140)	$p^{2)}$
Weight for age	-0.3 ± 0.9	0.2 ± 0.8	<.0001	-0.4 ± 1.0	0.2 ± 0.7	0.0005
Height for age	-0.5 ± 1.2	-0.2 ± 1.1	0.0879	-0.6 ± 1.1	-0.1 ± 1.0	0.0370
BMI for age	-0.1 ± 0.9	0.4 ± 1.1	0.0050	0.0 ± 0.9	0.3 ± 1.1	0.0783
Children aged 1 to 3 years (n=125)	Yes (n=35)	No (n=90)	$p^{2)}$	Yes (n=28)	No (n=97)	$p^{2)}$
Weight for age	-0.3 ± 1.0	0.2 ± 0.7	0.0217	-0.3 ± 1.1	0.2 ± 0.7	0.0244
Height for age	-0.4 ± 1.2	-0.2 ± 1.2	0.5285	-0.5 ± 1.3	-0.2 ± 1.2	0.3675
BMI for age	-0.1 ± 0.9	0.4 ± 1.1	0.0767	0.0 ± 0.9	0.3 ± 1.1	0.1669
Children aged 4 to 5 years (n=59)	Yes (n=13)	No (n=46)	$p^{2)}$	Yes (n=16)	No (n=43)	$p^{2)}$
Weight for age	-0.6 ± 0.6	0.2 ± 0.8	<.0001	-0.4 ± 0.8	0.2 ± 0.7	0.0083
Height for age	-0.8 ± 0.9	-0.1 ± 0.7	0.0041	-0.7 ± 0.9	-0.1 ± 0.7	0.0073
BMI for age	-0.1 ± 0.7	0.4 ± 0.9	0.0172	0.0 ± 0.9	0.4 ± 0.9	0.2921

[1)] Z-score of each growth indicator is shown in mean ± SD

[2)] By ANCOVA, adjusted for age, sex, and education level of both parents

Table 8 . Difference of growth status between picky eaters and non-picky eaters with picky eating behaviors of children

Growth status (z-score)[1]	Eating small amount			Neophobic behavior			Refusal of specific food groups			Preference for a specific food preparation method		
Total subjects (n=184)	Yes (n=55)	No (n=129)	p[2]	Yes (n=60)	No (n=124)	p[2]	≥ 2[3] (n=82)	0 – 1[3] (n=103)	p[2]	≥ 1[3] (n=92)	0[3] (n=93)	p[2]
Weight for age	-0.2 ± 0.9	0.2 ± 0.8	0.0010	0.1 ± 0.9	0.1 ± 0.8	0.9797	0.0 ± 0.9	0.1 ± 0.7	0.4137	0.1 ± 0.8	0.0 ± 0.8	0.2268
Height for age	-0.5 ± 1.1	-0.2 ± 1.1	0.0545	-0.5 ± 1.3	-0.2 ± 1.0	0.1057	-0.3 ± 1.1	-0.2 ± 1.1	0.8774	-0.1 ± 1.1	-0.4 ± 1.1	0.0275
BMI for age	0.0 ± 1.3	0.4 ± 0.9	0.0278	0.5 ± 1.1	0.2 ± 1.0	0.1329	0.2 ± 0.9	0.3 ± 1.1	0.4653	0.2 ± 0.9	0.3 ± 1.2	0.4831
Children aged 1 to 3 years (n=125)	Yes (n=42)	No (n=83)	p[2]	Yes (n=32)	No (n=93)	p[2]	≥ 2[3] (n=52)	0 – 1[3] (n=73)	p[2]	≥ 1[3] (n=62)	0[3] (n=64)	p[2]
Weight for age	-0.1 ± 0.9	0.2 ± 0.8	0.0911	0.0 ± 1.0	0.1 ± 0.8	0.8962	0.1 ± 1.0	0.1 ± 0.7	0.6288	0.1 ± 0.9	0.0 ± 0.8	0.5295
Height for age	-0.4 ± 1.2	-0.2 ± 1.2	0.3665	-0.7 ± 1.5	-0.1 ± 1.0	0.0657	-0.2 ± 1.2	-0.3 ± 1.2	0.3806	-0.1 ± 1.2	-0.4 ± 1.2	0.1739
BMI for age	0.1 ± 1.3	0.3 ± 0.9	0.2833	0.6 ± 1.2	0.1 ± 1.0	0.0575	0.2 ± 0.8	0.2 ± 1.2	0.8383	0.2 ± 0.9	0.3 ± 1.3	0.6564
Children aged 4 to 5 years (n=59)	Yes (n=13)	No (n=46)	p[2]	Yes (n=28)	No (n=32)	p[2]	≥ 2[3] (n=29)	0 – 1[3] (n=30)	p[2]	≥ 1[3] (n=30)	0[3] (n=29)	p[2]
Weight for age	-0.6 ± 0.7	0.2 ± 0.7	0.0007	0.1 ± 0.8	0.0 ± 0.8	0.9373	-0.2 ± 0.8	0.2 ± 0.8	0.0750	0.1 ± 0.8	0.0 ± 0.8	0.3427
Height for age	-0.8 ± 0.7	-0.1 ± 0.8	0.0049	-0.2 ± 0.9	-0.3 ± 0.7	0.8754	-0.5 ± 0.9	-0.1 ± 0.7	0.0450	-0.1 ± 0.8	-0.4 ± 0.8	0.1434
BMI for age	-0.2 ± 0.9	0.4 ± 0.9	0.0194	0.3 ± 0.9	0.3 ± 0.9	0.9966	0.2 ± 0.9	0.4 ± 0.9	0.8184	0.2 ± 1.0	0.4 ± 0.9	0.7406

[1] Z-score of each growth indicator is shown in mean ± SD

[2] By ANCOVA, adjusted for age, sex, and education level of both parents

[3] The number of food groups

5. Association between caregiver's perception and child's picky eating behaviors

Caregiver's perception included two variables, feeding difficulty and pickiness. The association between these two constructs is shown in table 9. Among 44 children who perceived as picky eater, 68.2% of children were considered as having 'feeding difficulty'. 'Pickiness' were strongly associated with 'feeding difficulty'.

Caregiver's perception about 'feeding difficulty' and 'pickiness' was related to specific picky eating behaviors, as shown in table 10. Children considered to have 'feeding difficulty' were likely to be picky eaters in 'eating small amounts', 'refusal of specific food groups', and 'preference for a specific food preparation method'. Also, children with 'pickiness' were likely to be picky eaters in all eating behaviors. 'Feeding difficulty' and 'Pickiness' were strongly correlated with 'eating small amounts'; however, they were modestly associated with other behaviors, especially with 'neophobic behavior'.

Table 9. Association between caregiver's perception of pickiness and feeding difficulty (n=184)

		Feeding difficulty		
		Yes (n=48)	No (n=136)	p[1)]
Pickiness	Yes (n=44)	30 (68.2)	14 (31.8)	<.0001
	No (n=140)	18 (12.9)	122 (87.1)	

[1)] Pearson's chi-square test

Table 10. Association between child's picky eating behaviors and caregiver's perception (n=184)

		Feeding difficulty			Pickiness		
		Yes (n=48)	No (n=136)	p[1)]	Yes (n=44)	No (n=140)	p[1)]
Picky eating behaviors of children							
Eating small amounts	Yes (n=55)	35 (72.9)	20 (14.7)	<.0001	33 (75.0)	22 (15.7)	<.0001
	No (n=129)	13 (27.1)	116 (85.3)		11 (25.0)	118 (84.3)	
Neophobic behavior	Yes (n=60)	22 (45.8)	38 (27.9)	0.0230	27 (61.4)	33 (23.6)	<.0001
	No (n=124)	26 (54.2)	98 (72.1)		17 (38.6)	107 (76.4)	
Refusal of specific food groups	≥ 2[2)] (n=81)	34 (70.8)	47 (34.6)	<.0001	35 (79.6)	46 (32.9)	<.0001
	0 – 1[2)] (n=103)	14 (29.2)	89 (65.4)		9 (20.5)	94 (67.1)	
Preference for a specific food preparation method	≥ 1[2)] (n=91)	31 (64.6)	60 (44.1)	0.0148	34 (77.3)	57 (40.7)	<.0001
	0[2)] (n=93)	17 (35.4)	76 (55.9)		10 (22.7)	83 (59.3)	

	Feeding difficulty		Pickiness	
	r[3)]	p[3)]	r[3)]	p[3)]
Picky eating behaviors				
Eating small amount	0.8140	<.0001	0.7230	<.0001
Neophobic behavior	0.2625	0.0003	0.3742	<.0001
Refusal of specific food groups	0.3269	<.0001	0.4725	<.0001
Preference for a specific food preparation method	0.2900	<.0001	0.4347	<.0001

[1)] Pearson's chi-square test

[2)] The number of food groups

[3)] Pearson's correlation coefficient for mean score of each constructs

V. DISCUSSION

This study assessed the prevalence of picky eating habits and the relationship with dietary intake and growth status of children aged 1 to 5 years in a certain area of Korea.

The proportion of picky eaters assessed by perception of caregivers in this study was similar with other studies, which measured picky eaters by the response of caregivers on the same question – "Is your child a picky eater?"(Jacobi et al. 2008, Carruth et al. 2004, Li et al. 2001, Lee 2013). The prevalence of specific picky eating behaviors was greater than that of perception of caregivers in this study; however it was lower than that of some Korean children reported in a previous study (Shim et al. 2013). This may be attributed not only to differences in measurement and assessment of picky eating behaviors, especially 'refusal of specific food groups' and 'preference for a specific food preparation method', but also to the sociodemographic characteristics such as the education level of the parents or household income.

Picky eating was negatively related with the education level of parents and household income, and were affected by parental feeding practices (Dubois et al. 2007a, Evans et al. 2011). There was no difference of sociodemographic characteristics regarding perception of caregivers and the aspects of differences were differed in each specific picky eating behavior in this study. It seems to result from the small sample size with favorable education level and household income. Other characteristics are also related with picky eating behaviors. The risk of being pickiness was reduced by the adherence to infant feeding guidelines, especially exclusively breastfeeding for 6 months of life

(Shim et al. 2011). Many studies have suggested that authoritative parental feeding practices such as pressure, have a negative influence on child eating behaviors (Galloway et al. 2005, van der Horst 2012, Evans et al. 2011, Kim et al. 2006). A mother's dietary habits, such as insufficient vegetable intake, food neophobia, and an unwillingness to eat healthily were likely to increase picky eating behaviors in their children (Galloway et al. 2003).

Individual variations among children also seem to lead to differences in behaviors (Nicklaus et al. 2005). Children with a higher weight status had a lower tendency to be picky eaters (Carruth et al. 2004), and certain kinds of temperament involving factors like rhythmicity and activity seem to be related to picky eating (Kim et al. 2006). Anxiety or the emotional status of the child has an influence on eating behaviors and the temporary condition at feeding time is also related with pickiness (Galloway et al. 2003, Wardle and Cooke 2008). Food experience in relation to the development of the child is also another influential factor. The ages of the children were related to picky eating behaviors. A study reported that the prevalence of picky eating in infants or toddlers increased as the child grew up, but it did not reveal which behaviors were affected by age (Carruth et al. 2004). In this study, older children were more likely to have a 'neophobic behavior', whereas younger children were likely to be perceived as picky eaters with 'eating small amounts'. A potential lifespan model explaining food neophobia suggested that neophobic behavior to new food is formed in early childhood and peeks at between the ages of 2 and 6 years, and then decreases (Dovey et al. 2008).

This finding may support the result that there were more picky eaters in the older age group (4 to 5 years). The variety of food selection among the children was also affected by the transition from breastmilk or formula to solid foods because of the sudden exposure to the unfamiliar texture and flavor of new foods (Nicklaus 2009). It was reported that the adherence to infant feeding guidelines, especially exclusively breastfeeding for 6 months of like, reduced the expression of picky eating behaviors (Shim et al. 2011). However, there were no difference of infant feeding practices between picky eaters and non-picky eaters in this study.

Perception of caregivers about 'feeding difficulty' and 'pickiness' of child were strongly associated with each other and result in lower nutrient intake and poor growth. 'Pickiness' result in the greater differences of nutrient intake and growth status of children, especially lower nutrient density of iron and niacin then 'feeding difficulty'. It was also reported in previous studies: picky eating children consumed a lower intake of energy and nutrients such as vitamin E, folate, and dietary fiber (Galloway et al. 2005, Dubois et al. 2007b, Carruth et al. 2004, Carruth et al. 1998). One study suggested that picky eaters did not meet their nutritional needs for calcium, iron, zinc, vitamin D, and vitamin E (Carruth et al. 1998).

It was similar with the differences of dietary and growth status by 'eating small amounts'. Children 'eating small amounts' consumed less energy and nutrients and had a lower growth status compared to non-picky eaters. This behavior seems to be the most critical element of picky eating problems, although it was the least prevalent eating

behavior. The frequently reported behaviors of picky eaters were spitting food out, eating avoidance, or throwing food, which are involved in parents' feeding problems (Lewinsohn et al. 2005). These problems may induce 'eating small amounts'. Also, caregivers who felt feeding difficulty reported their child had a low appetite, as caregivers in this study reported feeding problems due to their child's low appetite or unwillingness to eat (Wright et al. 2006). These fussy behaviors, which lead to consuming less amount of food, can be related with insufficient nutrient intakes. However, it is need to study more about the cause and the influence of eating small amount of food on dietary and growth status.

Children with picky eating behaviors related to consuming limited variety of foods, such as those involved in 'neophobic behavior', 'refusal of specific food groups' and a 'preference for a specific food preparation method' may not be recognized as serious problems by parents. In the short term, there were no significant differences in energy and most of the nutrient intake, as compared to non-picky eaters. However children with food neophobia or food rejection had a lower quality of diet for some micronutrients. In other studies, food neophobia and food rejection were related with limited preference for all food groups, especially vegetables and fruits (Russell and Worsley 2008, Cooke et al. 2003). The most and the least refused food groups of children in this study were similar with the previous results that children tend to show dislike and pickiness with shellfish and vegetables, and to prefer and be familiar with fish and fruits (Shim et al. 2013). Some studies also reported a dislike of vegetables, and the preference for energy-dense foods

such as sweets and high fat foods were generally prevalent among children (Skinner et al. 2002, Wardle and Cooke 2008, Birch and Fisher 1998, Nicklaus et al. 2005). A low quality of diet causes lower consumption of nutrients when the quantitative needs increase (Nicklaus 2009), which lead to insufficient nutrient intakes. Low diet quality and diet diversity can also influence energy intake, obesity and chronic disease in adults (Rivera et al. 2003, Nicklas et al. 2001).

Moreover, it has been reported that the main reason for rejecting foods was distaste, but change of color was positive effect on the correction of neophobic behavior (Addessi et al. 2005, Koivisto and Sjoden 1996). These findings imply changes of taste and shape of food positively influence food intake, as there were no significant differences in terms of preference for a specific food preparation method in this study. In addition, a positive experience when encountering new foods such as pleasure associated with eating and cooking enjoyment, may reduce the risk of picky behaviors (van der Horst 2012). Studies have suggested that some picky eating behaviors in early childhood may be related to the risk of eating disorders, such as Anorexia Nervosa and Bulimia Nervosa (Kotler et al. 2001); in this respect, therefore, the impact of 'preference for a specific food preparation method' needs to be assessed in the further studies.

Inadequate intakes of some critical nutrients, as in this study, were influenced by eating problems and may cause poor growth, especially iron, zinc, and vitamin A (Goulet 2010, Rivera et al. 2003). Picky eaters with perception of caregivers about 'feeding difficulty' and 'pickiness' had lower growth status and this influence was strongly shown in older

age group who had growth retardation for all growth indices. This study also found that children who ate small amount of food had a lower growth status. Some studies suggested that children with eating problem were low in growth and gained less weight (Wright et al. 2007, Dubois et al. 2007a, Carruth et al. 2004). Picky eating children were more likely to be underweight, as reported in a longitudinal study (Dubois et al. 2007a). This growth problem induced by picky eating behaviors becomes more severe when the child grows up. The older age group with picky eating habits in this study had a lower weight and height. The risk of being underweight was likely to increase when the picky eating problem continued as the children became older (Dubois et al. 2007a).

In contrast, food neophobia or dislike of food groups did not clearly induce growth problems in this study because there was an enough intake of energy. This confirms a study that reported there was no significant difference in growth status if the picky eating behaviors were not accompanied by insufficient dietary intake (Shim et al. 2013). However, the 'refusal of some food groups' was related to lower height-for-age of children aged 4 to 5 years in this study and younger children with 'neophobic behavior' might be likely to have a lower height-for-age and higher BMI-for-age. It suggests that if food neophobia is not appropriately countered at the period of introduction of complementary food, it may cause long-term problems of refusing some foods and negatively influencing on growth. It is possible that such behaviors create growth and health problems in adolescence and adulthood, ensuing from a lower intake of iron and

vitamin A, as some longitudinal studies have found these fussy behaviors continued until adolescence (Mascola et al. 2010, Dubois et al. 2007a).

Compared the perception of caregivers and specific picky eating behaviors, 'eating small amounts' had strong relations to both 'feeding difficulty' and 'pickiness'. It implies the most difficult problem which parents experience is encouraging their child to eat a sufficient amount of food. The problems of 'neophobic behavior', 'refusal of specific food groups', and 'preference for a specific food preparation method' were considered as somewhat pickiness; however they may not suffer the caregivers. One study reported a similar finding that child's pickiness was related to parents' frequent struggles over food and hardiness to feed child in children aged 4 to 5 years (Jacobi et al. 2003). Otherwise, a study reported that parents of 11-year-old children were more likely to be struggle with their child over food and more focused on the preferred food types than eating amounts (Mascola et al. 2010). There are some differences of study participants between studies, so the cause of feeding problem is needed to further study.

In this study, the prevalence of picky eaters and the association between dietary intake and growth status and picky eating problems were investigated using multi-faceted approach and it was confirmed that 'eating small amounts' could influence a child's nutritional status and growth. Based on these findings, appropriate interventions could be implemented to improve child's eating problem. However, there are some limitations. It was conducted as a cross-sectional study on a well-educated small-scale sample who lived in a metropolitan area. Thus, the influence of potential confounders, such as

Nutrition Plus participation and household income were not identified, and the continuity of specific picky eating behaviors was not investigated. The association between picky eating behaviors and the adequacy of nutrient intake and growth status were not assessed and the differences between age groups were not clear due to the small sample size.

Further study is required to assess the influence of picky eating problems on various subjects and appropriate sample size, to assess the causal association with the influence of eating amount, and to monitor the association between other picky behaviors and various growth indicators by using longitudinal research. In addition, the picky eating behaviors as well as perception of caregivers about picky eating were assessed based on the responses of caregivers. Thus, the development of method more free from error, such as observation, is required to accurately assess the eating behaviors of children.

VI. SUMMARY AND CONCLUSION

This study examined the association between picky eating habits and nutritional and growth status in early childhood by two directional approaches including perception of caregivers and specific picky eating behaviors of children and the relations between these two concepts and children's nutritional and growth status were assessed among 1- to 5-year-old children lived in Seoul Metropolitan Area, Korea. The results were as followings;

i. The distribution of picky eaters was different in each picky eating construct. Children with pickiness were was about 24% of total subjects, which were the lowest proportion. Among picky eating behaviors of children, the most frequent picky eating behavior was 'preference for a specific food preparation method' (49.5%) and the least frequent behavior was 'eating small amounts' (29.9%). In addition, children aged 4 to 5 years were likely to have picky eating behaviors, especially food neophobia.

ii. Shellfish was the most refused food group (37.6%) and the most required food group to be prepared in a certain way (26.4) but eggs was a less picky food group (4.4% for 'refusal of specific food groups' and 3.3% for 'preference for a specific food-preparation method). Fish was one of the lowest refused food groups (3.8%) but highly required to be prepared in a certain way (17.9%).

iii. Children who perceived by their caregivers as having 'feeding difficulty' and 'pickiness' had lower intake of energy and most of micronutrients, except

calcium and vitamin C, and low nutrient density of iron. Children who ate small amounts of food also had lower intake of energy, however no difference of nutrient density. Other picky eating behaviors were related to have lower nutrient density of some micronutrients.

iv. Picky eaters with perception of caregivers and 'eating small amounts' had lower growth status and the difference was greater in older age group aged 4 to 5 years. There was no significant differences between other picky eating behaviors and growth status of children.

v. Children who perceived as picky eaters by their caregivers were likely to have picky eating behaviors and 'eating small amounts' had significantly strong relation to perception of caregivers (R=0.8140 for 'feeding difficulty' and R=0.7230 for 'pickiness'), unlike other behaviors.

In this results, the prevalence of picky eaters were high in Korea, as other countries. Picky eating problems were related to lower nutrient intakes and lower growth status. Especially, 'eating small amounts' were strongly related to the insufficient nutrient intake, and caused unfavorable growth status and caregivers were mainly concerned about their child's eating amounts of foods. This picky eating problems is likely to continue until adolescence and adulthood, and to lead to inadequate diet and related health problems. However, the severity of picky eating problems has not been recognized well and studies about the cause and influence of 'eating small amount' have not been conducted in depth.

Thus, proper intervention and education are required to improve the eating behaviors of children and the feeding practices of caregivers. Also, the development of measurement about important picky eating behaviors such as eating small amounts is

needed and the development of errorless measurement is needed. Future longitudinal studies are necessary to monitor the lasting association of picky behaviors with diet and growth using a representative sample with an appropriate size.

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국문초록

까다로운 식습관은 유아에게서 흔히 나타나는 식사 문제로, 이러한 식습관은 유아의 부적절한 영양 섭취와 성장 문제를 유발할 수 있으며, 유아의 식품 선호 등 몇몇 식습관은 성인기까지 지속될 수 있다는 점에서 우려가 되고 있다. 하지만 까다로운 식습관의 개념과 측정 방법은 연구자에 따라 다르게 정의되고 있으며, 다양한 까다로운 식행동과 영양 상태의 연관성에 대한 연구는 아직 부족한 실정이다. 따라서 본 연구는 유아의 까다로운 식습관을 다면적인 접근 방법을 통해 평가하고 이에 따른 영양소 섭취와 성장 상태를 평가하고자 하였다.

본 연구는 서울 및 수도권에 거주하는 만 1 – 5세 유아의 양육자를 대상으로 한 단면 연구로서, 2014년 9월부터 2015년 7월까지 자발적으로 연구에 참여한 양육자를 대상으로 유아의 식습관 및 양육환경 조사, 신체계측 조사, 비연속적인 3일 식사기록을 통한 식이섭취조사를 수행하였다. 수집된 총 221명의 자료 중 식이섭취조사를 완료하고 식품알레르기 및 기타 식사섭취에 영향을 주는 의학적 문제가 없는 유아 184명의 자료를 분석하였다.

까다로운 식습관의 다면적 평가를 위하여 밥 먹이기의 어려움 및 유아의 까다로움에 대한 양육자의 인식과 유아의 까다로운 식행동을 조사하였다. 유아의 까다로운 식행동은 적은 식사량, 새로운 식품에 대한 거부감, 특정 식품군 거부, 특정 조리법 선호의 네 영역으로 측정하였다. 까다로운 유아와 까다롭지 않은 유아의 영양소 섭취 및 성장 상태의 차이는 인구사회학적 특성을 보정하여 공분산분석을 시행하였다.

양육자가 까다로운 식습관을 가진 것으로 인식한 유아의 분포는 기존 연구와 유사하게 나타났으며, 까다로운 식행동을 가진 유아의 비율은 기존 연구에 비해 낮았다. 양육자의 인식에 비해 유아의 까다로운 식행동의 분포가 높게 나타났으며, 유아의 까다로운 식행동의 경우 특정 조리법 선호를 보인 유아가 가장 많았고, 적은 식사량에서 가장 낮게 나타났다. 밥 먹이기의 어려움과 유아의 까다로움에 대한 양육자의 인식은 에너지와 몇 가지 미량영양소의 섭취 부족과 관련이 있었으며, 낮은 성장상태와도 높은 연관성을 보였다. 이러한 경향은 특히 만 4 – 5 세의 유아에서 두드러지게 나타났다. 적은 식사량을 보인 유아는 그렇지 않은 유아에 비해 칼슘을 제외한 에너지와 대부분의 미량영양소를 적게 섭취한 반면, 새로운 식품에 대한 거부감, 특정 식품군 거부, 특정 조리법 선호 등의 까다로운 식행동은 몇 가지 미량영양소의 낮은 영양소 밀도와 관련이 있었다. 유아의 적은 식사량은 성장수준이 낮은 것과 관련이 높았으나, 다른 식행동의 경우 까다로운 유아와 그렇지 않은 유아의 성장 상태에 유의미한 차이를 보이지 않았다. 양육자가 밥 먹이기의 어려움과 까다로움을 보인다고 평가한 유아의 경우 까다로운 식행동을 보이는 빈도가 높았으며, 특히 적은 식사량은 양육자의 인식과 높은 상관관계를 보였다.

본 연구를 통하여 적은 식사량을 비롯한 까다로운 식습관이 유아의 부족한 영양 섭취 및 낮은 성장 수준에 미치는 영향을 확인하였으며, 이러한 식습관과 양육자의 식사지도의 어려움의 관련성을 확인할 수 있었다. 하지만 적은 식사량과 같은 주요한 까다로운 식습관의 원인 및 영향에 대한 연구는 부족한 실정이다. 따라서 유아의 건강한 식습관

형성을 위해 양육자의 적절한 식사지도에 대한 교육과 식습관 개선에 대한 연구가 필요하다.

주요어: 까다로운 식습관, 적은 식사량, 유아, 영양소 섭취, 성장

학번: 2014-20364

Appendix

Table A. Picky eating questionnaire

Feeding difficulty

1. 귀하의 자녀에게 밥을 먹이는데 어려움이 있나요?

거의 없음				매우 많음

①……②……③……④……⑤

Pickiness

2. 귀하는 자녀의 식습관이 까다롭다고 생각하십니까?

매우 그렇지 않음				매우 그러함

①……②……③……④……⑤

Eating small amounts

3. 귀하의 자녀는 귀하가 기대하는 양만큼의 밥을 먹는 경우가 얼마나 자주 있나요?

거의 없음				거의 항상

①……②……③……④……⑤

4. 귀하는 자녀에게 밥을 먹이려고 애쓰는 경우가 얼마나 자주 있나요?

거의 없음				거의 항상

①……②……③……④……⑤

5. 귀하의 자녀는 식욕이 어떠한가요?

매우 나쁨				매우 좋음

①……②……③……④……⑤

Neophobic behavior

6. 귀하의 자녀는 그동안 먹어보지 못한 새로운 음식을 먹어보려고 하는 경우가 얼마나 자주 있나요?

거의 없음				거의 항상

①……②……③……④……⑤

7. 귀하의 자녀는 그동안 먹어보지 못했던 새로운 음식을 주면 얼마나 잘 먹으려고 하나요?

거의 먹지 않음				매우 잘 먹음

①……②……③……④……⑤

Refusal of specific food groups

8. 귀하의 자녀가 다음 식품들을 먹으려 하지 않는 경우가 얼마나 자주 있나요?

식품	① 거의 없음	②	③	④	⑤ 거의 항상
콩류	□	□	□	□	□
채소	□	□	□	□	□
버섯	□	□	□	□	□
미역 등 해초	□	□	□	□	□
육류	□	□	□	□	□
생선	□	□	□	□	□
새우	□	□	□	□	□
조개	□	□	□	□	□
계란	□	□	□	□	□
과일	□	□	□	□	□
우유	□	□	□	□	□
요쿠르트/요플레	□	□	□	□	□

Preference for a specific food preparation method

9. 귀하의 자녀가 조리방법에 따라 먹기도 하고, 먹지 않기도 하는 차이가 생기는 경우가 얼마나 자주 있는지 각각의 식품에 대해서도 답해주세요.

식품	① 거의 없음	②	③	④	⑤ 거의 항상
콩류	□	□	□	□	□
채소	□	□	□	□	□
버섯	□	□	□	□	□
미역 등 해초	□	□	□	□	□
육류	□	□	□	□	□
생선	□	□	□	□	□
새우	□	□	□	□	□
조개	□	□	□	□	□
계란	□	□	□	□	□